REMARKS

The final Office Action of February 21, 2003 has been received and carefully considered. Accordingly, claims 1 and 11 have been amended, and claims 9 and 14-16 have been canceled thereby leaving claims 1-8 and 10-13 as currently pending. Initially, the Applicants wish to sincerely thank Supervisor Utech for the courtesies extended to the Applicants' representatives during the personal interview of July 21, 2003. Further, in light of the amendments presented above and for the reasons to follow, reconsideration of the rejections of record is requested.

Referring now to the detailed Office Action, claims 1-16 are rejected under 35 U.S.C. §112, first paragraph, as containing a description in the specification which fails to convey to one skilled in the relevant art that the inventors, at the time of filing the application, had possession of the subject matter of the claims since the limitation of distributing a nonmetal element towards an inner portion of a substrate is not set forth in the specification. Since the amendments to claims 1 and 11 above remove the above limitation from the claims, the Applicants urge that this rejection has been rendered moot.

With regard to the rejection of claims 9 and 14, under 35 U.S.C. §112, second paragraph, as being indefinite and failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention, the Applicants further urge that with the cancellation of the above claims 9 and 14-16, this rejection has also been rendered moot.

With regard to the rejections of:

Claims 1-16, under 35 U.S.C. § 103(a), as being obvious in view of the teachings of Tung ('625) combined with the teachings of Sugano et al et al ('527),

Claims 1-16, under 35 U.S.C. § 103(a), as being obvious in view of the teachings of Maa et al ('775) combined with the teachings of Sugano et al et al ('527), and

Claims 9 and 14-16, rejected under 35 U.S.C. § 103(a), as being obvious in view of the teachings of Tung ('625) or Maa et al ('775) combined with the teachings of Sugano et al et al ('527) and Yamazaki et al ('579),

each of these rejections is respectfully traversed.

Initially, it is noted that the rejection of claims 9 and 14-16, under § 103(a), has been rendered moot by the cancellation of those claims.

The presently claimed invention is directed generally to a process for fabricating a semiconductor device including the steps of:

distributing a nonmetal element composed of an oxygen element, a nitrogen element or a flouring element in a region in the vicinity of a surface portion of a semiconductor layer, and thereafter,

depositing a metal film on the semiconductor layer, and

epitaxially growing a semiconductor-metal compound layer in the surface portion of said semiconductor layer by causing a reaction between the element included in the semiconductor layer and a metal included in the metal film by annealing of the metal film.

According to the presently claimed invention, since the nonmetal element composed of an oxygen element, a nitrogen element or a fluorine element is distributed in a region in the vicinity of the surface portion of the semiconductor layer and since the oxygen, nitrogen and fluorine elements are different from the elements, such as arsenic, phosphorus, boron and indium, used in the manufacture of the diffusion layers or regions in a semiconductor device, no adverse effect upon the diffusion layers will result from employing the oxygen, nitrogen or fluorine elements as claimed.

Further, in the present invention as illustrated in Figures 3(a)-3(c) and set forth in claim 11, oxygen atoms are distributed in the surface of the (N-type) high concentration impurity layer (108) or the surface of the gate electrode (105) by O_2 implantation via plasma doping. Accordingly, subsequent diffusion of the deposited (cobalt) metal atoms into either the high concentration impurity layer (108) or the gate

electrode (105) is prevented due to this distribution of the oxygen atoms in this vicinity of the surface portion of the high concentration impurity layer (108), or the gate electrode (105). That is, as discussed in the specification at page 20, line 3, to page 21, line 2, rapid reaction of the (cobalt) metal atoms and the (silicon) semiconductor atoms can be prevented which avoids the agglomeration and polycrystallization discussed in the background of the specification at pages 1-3. Consequently, a thick (cobalt silicide) semiconductor-metal compound can be formed by epitaxial growth.

According to the Examiner, the Tung reference, as illustrated in Figure 2B, teaches forming a thin oxide layer (200) having a thickness of 0.5 to about 1.5 nm on the surface of a silicon substrate (210). The oxide layer (200) is formed by subjecting the surface of the substrate to a chemical cleaning solution (column 5, lines 33-39). Thereafter, the cobalt layer (220) is formed over the oxide layer (200). The uniform thickness cobalt layer (220) is formed by e-beam evaporation or sputter deposition (column 5, lines 62-66). The cobalt layer (220) is then annealed for an amount of time sufficient to convert the cobalt to cobalt silicide (column 6, lines 11-19).

Therefore, it can be seen that the Tung reference does not teach the step of distributing the (oxygen, nitrogen, fluorine) nonmetal element (109) in the region in the vicinity of the surface portion of the semiconductor layer (110) as explicitly set forth (defined) in each embodiment of the invention in the specification, i.e., Figures 3(a)-3(c), 6(a)-6(c) and page 17, line 5, to page 18, line 8, and page 27, line 1, to page 28, line 4. That is, Tung does not distribute the (oxygen, nitrogen, fluorine) nonmetal element (109) inside the surface of the semiconductor as presently claimed. Of particular note is the teaching in the specification, at page 27, lines 6-25, that the mere application of a silicon oxide on the surface of the semiconductor does not result in the distribution of the (oxygen, nitrogen, fluorine) nonmetal element (109) inside the surface of the semiconductor as presently claimed, but instead the claimed distribution occurs when the silicon oxide coated surface is irradiated with a (Ar) particle beam.

To remedy this deficiency, the Examiner relies upon the teachings of the Sugano et al reference. However, Sugano et al teach depositing (see Figure 15B) on the silicon substrate (32) a silicon oxide (SiO_2) film (31) which is then irradiated with a neutron beam to produce lattice defects throughout the irradiated region of the silicon substrate (32) so as to make the silicon substrate semi-insulating (see Figure 15B). Thereafter, the silicon substrate (32) is annealed by irradiating the substrate (32) with laser beam pulses to form an activated layer (33) in the surface portions of the substrate (32) adjacent the silicon oxide film (31). The silicon oxide film is then removed and two ohmic contacts (34) are formed on the activated layer (33) (see column 11, line 67, to column 12, line 11).

However, Sugano et al fail to teach the step of distributing oxygen in the region in the vicinity of the surface portion of the semiconductor for excellent epitaxial growth. The Examiner attempts to overcome this deficiency of Sugano et al by stating that such a formation is inherent since a "similar irradiation of the compound layer with a particle beam" takes place in Sugano et al as in the presently disclosed invention. The Applicants assert that such a position is inconsistent the U.S. law and USPTO practice regarding the establishment of a proper case of inherency. That is, as the Examiner is aware, MPEP Chapter 2112, set forth the requirements for the Examiner in establishing "inherency" as:

> **EXAMINER MUST PROVIDE RATIONALE OR EVIDENCE TENDING TO SHOW INHERENCY**
>
> The fact that a certain result or characteristic **may** occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993)... *In re Oelrich*, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981). "To establish inherency, the extrinsic evidence **'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference**, and that **it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities**. The mere fact that a certain thing **may result** from a given set of circumstances is not sufficient.' " *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999).

> "In relying upon the theory of inherency, the examiner must provide **a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.**" *Ex parte Levy,* 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)... (Emphasis added)

The review of the teachings of Sugano et al above clearly establishes that one ordinary skill would not readily recognize that the neutron beam irradiation process of Sugano et al of a silicon oxide layer (which is not the same as the instantly disclosed Ar beam irradiation process) would result in oxygen atoms from the oxide layer being distributed inside the surface of the semiconductor as presently disclosed and claimed. Further, the patentees make no mention of the constituents of the silicon oxide layer (31) being present inside the surface of the semiconductor layer (32).

With regard to the teachings of Maa et al (see Figure 2), the patentees teach that an active area (32) is formed on an oxide layer (14) on a substrate (10). The source (46) and drain (48) regions are formed (see column 3, lines 52-65) after providing the gate structure (30). Next, Maa et al (see Figure 4) teach depositing a layer of silicidation (cobalt) material (80) is formed on the substrate (see column 4, line 55, to column 5, line 4). Then a RTA process is performed (see Figure 5) to form a silicide at the boundary between the silicidation (cobalt) material (80) and the source (46) and drain (48) regions (see column 5, lines 5-15). Note, the patentees (see column 6, lines 50-63) teach that any *in situ* surface oxide formed on the surface of the silicide must be removed, such as by use of an Ar ion beam. This last step (of Ar beam cleaning of a surface oxide on a silicide) of Maa et al is not in any manner similar to the distribution of (oxygen) a nonmetal element (109) in the region in the vicinity of the surface portion of the semiconductor layer (110) via Ar ion beam irradiation of a silicon oxide layer as set forth in the specification, i.e., Figures 6(a)-6(c) and page 27, line 1, to page 28, line 4.

Therefore, it can be seen that the Maa et al reference does not teach the step of distributing the (oxygen, nitrogen, fluorine) nonmetal element (109) in the region in the vicinity of the surface portion of the semiconductor layer (110) as explicitly set

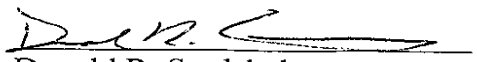
forth (defined) in each embodiment of the invention in the specification, i.e., Figures 3(a)-3(c), 6(a)-6(c) and page 17, line 5, to page 18, line 8, and page 27, line 1, to page 28, line 4. That is, Maa et al do not distribute the (oxygen, nitrogen, fluorine) nonmetal element (109) inside the surface of the semiconductor as presently claimed. To remedy this deficiency, the Examiner again relies upon the teachings of the Sugano et al reference. However, Sugano et al, for the reasons discussed above, does not explicitly or implicitly (inherently) teach distributing the (oxygen, nitrogen, fluorine) nonmetal element (109) in the region in the vicinity of the surface portion of the semiconductor layer (110) as presently claimed.

Hence, as Sugano et al, Maa et al and Tung are deficient for the reasons as discussed above, the references cannot be combined with proper motivation to explicitly or inherently teach or suggest the presently claimed invention. Consequently, the rejections of claims 1-16, under §103(a), have been set forth in error and must be withdrawn.

Having responded to the rejection set forth in the outstanding Final Office Action, it is submitted that claims 1-8, 10-13 are now in condition for allowance. An early and favorable Notice of Allowance is respectfully solicited. In the event that the Examiner is of the opinion that a brief telephone or personal interview will facilitate allowance of one or more of the above claims, the Examiner is courteously requested to contact Applicants' undersigned representative.

Lastly, it is noted that a separate Extension of Time Petition (two months) accompanies this response along with a check in payment of the requisite extension of time fee. However, should that petition become separated from this response, then this response should be construed as containing such a petition. Likewise, any overage or shortage in the required payment should be applied to Deposit Account No. 19-2380 (740819-559).

Respectfully submitted,



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